

Comments and Responses on SOCCR/SAP 2.2 Draft 1 (May 2006)
CHAPTER 11

COMMENT FROM PEER REVIEWERS						AUTHOR'S RESPONSE						
Comment Number	Reviewer ID	Chapter	Page	Line	Comment Text	Acknowledged, but no further response or revisions are required	Revisions have been incorporated as suggested in the comment	Agree, but see "Notes on Response"	Agree, but elaboration is precluded by length limitations	Disagree; see "Notes on Response"	Beyond scope of report/chapter	Notes on Response
11-001	14	11	General		The scope and intent of the synthesis and assessment product are clearly described in the report.	X						no response required
11-002	14	11	General		As detailed in the following four comments, all aspects of this charge have not been fully addressed.	X						no response required
11-003	14	11	General		The report deals extensively with two topics: (a) forest carbon stocks and fluxes at three scales: continental, national and forest stands, and (b) ecological factors affecting forest carbon stocks and fluxes at the stand scale.	X						no response required
11-004	14	11	General		Social and economic factors affecting forest carbon sequestration at all scales are mentioned occasionally (e.g., lines 1-6 on page 11-10) but are not considered in sufficient detail. This is surprising given that the first sentence of the section titled "Effects of Climate and Atmospheric Chemistry" acknowledges that "the combined effects of climate and atmospheric chemistry changes on carbon sequestration are likely to be significantly smaller than the effects of land management and land use change" (p. 11-7). Highly relevant topics that are not adequately addressed include government policies, markets for forest products, technological innovation in forest management and wood processing, and trends in investment in the forest sector.		X	X	X	X		Agree partially, but space limitations prohibit adding much additional detail. Note that there are extensive sections on land-use change, forest management including technology, economics and market considerations. Expanded policy discussion a bit in places, but only very generally so as to keep from appearing "policy prescriptive"..
11-005	14	11	General		Landscape and regional scales of analysis are all but ignored. This is unfortunate because social, economic, and ecological factors affecting carbon sequestration have important effects at these scales.				X			With 3 countries to address, and space limitations, I don't see how we can explicitly address landscape-scale and regional analyses.
11-006	14	11	General		The report recognizes carbon sequestration in wood products in several places, but virtually ignores other potential contributions of active forest management to reducing greenhouse gases including (a) production of renewable biomass energy, and (b) production of renewable materials that have lower life-cycle emissions of greenhouse gases than non-renewable alternatives.		X	X		X		There is some economic description of biofuels on p. 11, but nothing on product substitution. Revised "Options for Management" section to highlight these options more.
11-007	14	11	11-4		It is stated that "Large-scale estimates of ecosystem carbon fluxes can only be explained by a more detailed examination of the dynamics of individual forest stands that have unique combinations of disturbance history, management intensity, vegetation, and site characteristics." This statement has important implications for research priorities, but is unsupported by evidence, analysis, or argument. The statement is probably false if "large-scale" is taken to include regional and national scales. To my knowledge, no one has demonstrated the feasibility of scaling-up observations of stand dynamics to explain estimates of carbon fluxes at regional and national scales. Methodologies that integrate information from several scales are more likely to be successful.		X	X		X		Partially agree -- can clarify statement on p. 4. Disagree that scaling-up is not being done, we do it all the time as we use ecosystem studies to develop models that augment our national-scale observations.
11-008	14	11	11-8		The text includes the statement that "... a long-term increase in impacts of disturbance is likely in the future, with associated losses of forest carbon stocks." This statement is unsupported by evidence, analysis, or argument.		X					Changed "likely" to "possible".

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11-009	14	11	11-12		The text includes the statement that "Effective carbon management options to increase the retention time of sequestered carbon require a thorough understanding of current carbon stock sizes and flux rates in boreal, temperate, and tropical forest ecosystems in North America." Implicit in this statement is the assertion that "increasing the retention time of sequestered carbon" is a promising strategy that merits special consideration. This assertion is unsupported by evidence, analysis, or argument.		X					Reworded statement - deleted misleading phrase.
11-010	14	11	11-13		The text includes the statement that "With the exception of land use change (afforestation and deforestation), there is very little information about how forest management affects various carbon pools..." This is obviously incorrect. There are many useful papers and books on effects of forest management on various carbon pools.		X			X		Clarified statement -- although there are books and general references, and some very specific studies, it is still impossible to make very specific recommendations to landowners.
11-011	14	11	11-13		The text includes the statement that "Few decision-support tools are available..." Taken literally, this statement is obviously incorrect. No doubt the authors were intending to refer to some particular kind of decision for which tools are lacking. The section on decision support tools is weak and needs to be reworked.		X		X	X		Clarified statement to highlight that there are few decision-support tools specific for carbon management. But there is no room to elaborate.
11-012	14	11	General		The report's exposition and organization need to be revised to address problem discussed above that report focuses too much on stand-level ecology and not enough on social, economic, and ecological factors affecting carbon sequestration at landscape and regional scales.					X		We followed the given organizational format. Stand-level ecology is still the best we have available to explain larger-scale observations and management options. No room to elaborate further on social and economic factors except as noted in response to comment 11-004.
11-013	14	11	General		The report's balance and fairness are compromised by its excessive focus on stand-level ecology and by its insufficient attention to potential contributions of active forest management to reducing greenhouse gases including (a) production of renewable biomass energy, and (b) production of renewable materials that have lower life cycle emissions of greenhouse gases than non-renewable alternatives.					X		See response to comments 11-006 and 11-012.
11-014	14	11	General		The report's lack of balance is exacerbated by Appendices 11A and 11B. The appendices give special attention to selected research approaches, results, and carbon accounting concepts but do not add substantial value to the overall report.					X		The appendices are included to highlight in significantly more detail areas of active and extensive research. We believe the main body of the report is well balanced.
11-015	14	11	General		The authors should consider condensing the material in the appendices and integrating it into the main text. For example, information on ecosystem carbon fluxes from eddy covariance and ground-based measurements (Appendix 11A) could be summarized in a single table and integrated into the main text section on "Carbon Stocks and Fluxes."					X		The material in the appendices is already summarized and integrated into the main text.

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11-016	14	11	11-23		The text includes the statement that "Mature forests can be substantial sinks for atmospheric carbon." This statement is presented without appropriate context and seems designed to promote forest preservation. A balanced presentation would also mention the potential for mature forests to be substantial sources of atmospheric carbon (e.g., high potential for wildfire in mature forests experiencing cohort senescence).			X		X		Suggest re-phrasing text to state that mature forests can have substantial stocks of sequestered carbon. The text immediately following this statement discusses the potential to be a source and is therefore already balanced. BIRDSEY
11-017	14	11	11-26		The fourth bullet offers the opinion that "replacement of fossil fuel by biomass fuel can be counted as an emissions offset, if residual or manufacturing "waste" would otherwise be lost via decomposition or other processes." This brief commentary on a single aspect of carbon accounting is clearly out of context and inappropriate.			X		X		Statement is not an opinion but the way registries count biomass burned for energy. Can add citation. Also suggest making the biofuel part of bullet 4 a new bullet 5. BIRDSEY
11-018	14	11	General		In regard to the report's findings being based on any value judgments or the collective opinions of the authors, see comments above regarding (a) need to broaden the scope of the report, and (b) concerns about Appendices.	X						See responses to individual previous comments.
11-019	18	11	General		The authors have done a very good job in synthesizing many diverse sources of data into a very coherent report on the influence of North American forests on the global carbon cycle. They have expressed their estimates of forest carbon pools, fluxes and balance in the context of actual tons of carbon and relative to the annual North American emissions from fossil fuel.	X						
11-020	18	11	General		The tables and charts the authors have provided will serve as a baseline for future assessments to be compared against. The uncertainties associated with their stated estimates are given.	X						
11-021	18	11	General		The major factors that drives changes in carbon sequestration, fluxes and pools were identified and discussed for the three countries that comprise North America. I think a table showing the relative ranking of these drivers over time, past (pre 1970), present (1970 to present) and future (next three decades) for each of the three countries would be useful. It would help to emphasize where there is or is not consistency over time and between countries in the factors that have made major influences on each countries carbon cycle. SEE EXAMPLE TABLE AS PROPOSED FOR THE USA IN ORIGINAL SET OF COMMENTS. Canada and Mexico rankings would be very different. I do not know if the above rankings are correct, just an example. The authors are in the best position to do the rankings and give uncertainties. These rankings will help us to focus on the main factors for each country that we need to influence through policy or science.			X				This would be a useful contribution, but the literature is simply not yet conclusive enough to give this ranking in a credible way for each country or for any country.

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11-022	18	11	General		For the important role that forests play in the North American Carbon balance, I think the introduction section should be beefed up. State the extent of forests relative to the total N.A. land area, its contribution to offsetting annual fossil fuel emissions of NA and the globe. Give the three fundamental ways that forests influence the carbon cycle-balance (1) CO2 sequestration, storage and emissions (2) a substitute fuel for fossil fuel (3) product substitution for high energy (fossil fuel) cost products.		X	X				Revised introduction
11-023	18	11	General		The authors should identify the major federal research or incentive programs that are in-place to advance our understanding of or to enhance the role of North American forests for mitigating carbon cycle imbalances. A table showing the programs, what each is expected to contribute (estimates of stand pools, changes in fluxes for the various major forest types, or mitigating/improving the role of forest for storing, offsetting fossil fuel emissions, etc) and which forest-types are being addressed and which are not would be useful. I think we may see we are heavy on the Science (understanding) side and light on the enhancing program side but I can't tell from this chapter. The research status and needs are one of the mandates of this report.				X			I think we have adequately identified research needs by country, but have not evaluated the research and incentive programs. Although a useful addition, seems like we don't have room for it.
11-024	18	11	General		From the authors results, it is clear that changes in land use, the extent that forest are used to offset fossil fuel and the management intensity of N.A. forest are the main factors that can be influenced through future research and policy changes to greatly enhance the role that NA forests play in solving the C imbalance issue. When only a small percent of the energy stored in NA forest trees (?? 1%) is being converted to offset fossil fuel, only 1% of the trees in managed forest are being harvested and most of the forest land are in the "Others" category (which is historically under-managed and under-utilized) this should send a strong signal that only a minor fraction of the potential for NA forests to affect the NA carbon balance is being realized. A statement of the potential role versus the estimated actual would be useful.		X	X	X			The reviewer makes an important point, but I don't see an easy way to insert this idea in the text given length limitations. I think the reviewer is getting partially at a) the balance between how many fossil C emissions are avoided in the process of biomass burning at a sustainable level of harvest, and partially at b) what is the sustainable level of harvest. I don't think either of these questions is especially well resolved in the literature, so would be very difficult to change the text.
11-025	18	11	General		Gaps should include: How do we get significantly more stored forest energy converted into an energy form that offsets fossil fuel use? We are using very little of the "renewable energy mine" we have and the potential to add to or regrow this energy source is large.		X	X				Revised text in "Options for management" section
11-026	18	11	General		Gaps should include: What are the most efficient ways (policies, programs) to get more acres into forests or to enhance the C sequestration rates of existing forest lands in each country?		X	X				Revised text in "Options for management" section
11-027	18	11	General		Gaps should include: How can we have better inventories of C pools by forest types and improve our ability to detect significant changes that are taking place in these pools?		X	X				Revised text in "Options for management" section

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11-028	18	11	General		Gaps should include: What Forest-types do we need better flux data for? Can we obtain this data smarter than we have in the past? For example, do we need continuous monitoring eddy-covariance sites for only a few forest types or do we know the key stand development stages that influence stand carbon fluxes and the key parameters we need to measure so we could take only periodic data and scale (model) carbon flux estimates over time and forest stand development? This would permit getting flux data estimates for more forest types and conditions.		X	X				Revised text in "C stocks and fluxes" section
11-029	19	11	General		While authors did a very thorough job at collecting relevant literature, the numerous reports and studies cited in the chapter are based on inconsistent definitional frameworks, categories, purposes, and approaches. Upon reading the entire chapter, my conclusion was that the data and knowledge currently available do not allow to make comprehensive statements on forest carbon dynamics and our ability to manipulate them, with any confidence, at the north American scale. The sections on data and knowledge gaps reinforced this conclusion. The wording of 'key findings' should better reflect this uncertainty	X						We obviously can do nothing about the inconsistency in the literature. Also it seems that we use "highly uncertain" and "lack of consensus" appropriately in the key findings section to reflect the uncertainty.
11-030	19	11	General		Clarify at the outset the purpose of compiling on the one hand, the findings of scientific studies on the complex factors driving carbon fluxes in and out of forests, their annual variability, long-term effect, and relative importance in different landscapes and social settings, and on the other hand national-scale estimates of C stocks and C stock changes (in the chapter's first sections), which often do not incorporate this scientific knowledge. Perhaps the chapter should point out with greater clarity the missing links between the two information types. Indeed, the complexity of the issues warrants a finer analysis. A valuable goal for the chapter, rather than listing options, gaps and needs in a semi-quantitative fashion, would be to attempt to identify and prioritize the key questions we should address to determine the potential for manipulating forest C dynamics to reduce atmospheric loading of CO ₂ . The challenge is to move from site-specific studies and qualitative statements to large-scale, quantitative assessments.	X			X	X	X	Disagree that national-scale estimates do not incorporate the more detailed scientific knowledge. Clearly there is work to do among the research community to integrate studies across scales, but I believe the "roadmap" to do this is outside the scope of this chapter. The research plan for the US CCSP is a good example of where this roadmap is already developed.
11-031	19	11	General		One also wonders if an ecosystem-based approach (tropical, temperate, boreal forests, with various levels of management intensity) should not be considered. Given the diversity of forests and forest management practices across the continent, the current, country-based assessment is too general.	X						We tried this in earlier versions, but found that it was very difficult to compile data for the ecosystem approach across country boundaries. This is a great goal for a future report.

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11-032	19	11	11-2	22	Forest products (FP) are not a carbon sink, since, as opposed to vegetation, they do not remove carbon from the atmosphere. Use clearer terminology, such as "C uptake" (by trees) and "C storage" (in forest ecosystems and FP). Authors should clarify the meaning of the data used to represent C stored in forest products (FP) in this chapter, since different estimation methodologies drastically affect these estimates (see also comment below on p 11-3).		X	X				Changed text, but note that in the U.S. the official definition of sink (at least one of the official definitions) would consider carbon in wood products a sink.
11-033	19	11	11-3	29 et seq.	For Canada, use Environment Canada's 2006 submission to the UNFCCC, as opposed to the 2005 version. The 2006 report contains vastly improved estimates. This reviewer can provide the updated data. Notably, Canada's managed forests were variously a source or a sink in the 1990-2004 period; in this context, the use of a single, undated and unexplained figure in Table 11-3 of the SOCCR is misleading. Annex 3 (section A3.5.7) of Environment Canada's 2006 GHG Inventory Report indicates that in 2004 off-site emissions from decaying FP are estimated between 91 and 135 Mt CO ₂ , depending on approaches. Again, using a single figure without further explanation lacks transparency.		X					
11-034	19	11	11-4	26	Remove "and wood products", since by and large the factors listed affected forest C dynamics, but not those of wood products.		X					
11-035	19	11	11-6	11-17	Update with Environment Canada's 2006 GHG Inventory Report. While forest and other wooded lands occupy 402 Mha, forests alone cover 310 Mha, and managed forests 255 Mha or 83% of all forests. On page 11-12, line 19, change also the 47% figure to 17%. Managed forests include private and public forests potentially subject to harvesting, and forests actively protected from fires.		X					
11-036	19	11	11-6	21-25	There is a need to reconcile the statement about the relative importance of harvesting and natural causes in tree death, with the statement on p 11-8 lines 10-11. The two sentences are somewhat inconsistent. On what kind of evidence relies the statement of lines 21-25 if evidence of the impact of disturbances is missing?		X					Text clarified
11-037	19	11	11-9		The section 'Options for management' needs further work. Remove p. 11-9, lines 26-31: this rather assertive statement reads like a conclusion, and is not warranted by the few examples provided. More examples are needed similar to the two Canadian examples of how forest management strategies could affect forest carbon dynamics in northern landscapes. On p. 11-10, lines 7-11 fail to mention the combination of strategies that could potentially yield such a significant increase in C sequestration by US forests. I doubt that the economic assesment of p11-11, lines 3 to 11 applies to the entire north American continent, or any of its component countries: provide context to these figures. What are the conclusions of this section, given the caveats of p 11-13?		X	X		X		Our given writing style was to put concluding statements up front to engage the reader, then elaborate. Unfortunately here is no space available for additional examples. Clarifying statement were added

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11-038	19	11	11-21	Table 11-1	Are there 'polar' forests?		X					
11-039	19	11	11-21	Table 11-3	Use figures in Environment Canada (2006) Canada's Greenhouse Gas Inventory 1990-2004. The use of a single figure is misleading, since during the 1990-2004 period the annual GHG budgets of Canada's managed forests vary between a sink of 186 Mt CO ₂ e and a source of 177 Mt CO ₂ e.		X					
11-040	7	11	General		Although this chapter provides useful aggregate statistics on forest carbon by biome and country, users of the chapter would benefit greatly from an analysis of spatial estimates of forest carbon. Such an analysis would involve matching estimates based on forest inventories divided by political unit and general forest type (Birdsey and Lewis 2003) with spatial estimates from remote sensing (Running et al. 2004). REFS: Birdsey, R.A. and G.M. Lewis. 2003. Carbon in U.S. forests and wood products, 1987-1997: State-by-state estimates. U.S. Department of Agriculture, Forest Service, Newtown Square, PA; Running S.W., R.R. Nemani, F.A. Heinsch, M. Zhao, M. Reeves, and H. Hashimoto. 2004. A continuous satellite derived measure of global terrestrial primary production. BioScience 54: 547-560.				X			This would be nice to do, but don't have the space.
11-041	7	11	General		Research at individual sites has combined analysis of forest inventories and remote sensing (for example, Van Tuyl et al. 2005, Turner et al. 2006). Therefore, I suggest adding a section "Spatial estimates of Forest Carbon" that would review the scientific literature and take a step towards producing a map of forest carbon across North America. REFS: Turner, D.P., W.D. Ritts, W.B. Cohen, S.T. Gower, S.W. Running, M. Zhao, M.H. Costa, A. Kirschbaum, J. Ham, S. Saleska, and D.E. Ahi. 2006. Evaluation of MODIS NPP and GPP products across multiple biomes. Remote Sensing of Environment 102: 282-292.				X			This would be nice to do, but don't have the space.
11-042	7	11	11-1	19	Instead of "highly uncertain," add the numerical error range to the estimate of 350 Mt C y ⁻¹ . From page 11-3 line 20, the error is ± 350 Mt C y ⁻¹ .			X				Cannot compute the range from the literature.
11-043	7	11	11-1	33-37	Identify the areas of development of better estimates of potential estimates of forest carbon under different scenarios of climate change. For example, Bachelet et al. (2003) have continued to improve the skill of the dynamic global vegetation model MC1 to simulate potential CO ₂ fertilization. REF: Bachelet, D., R.P. Neilson, T. Hickler, R.J. Drapek, J.M. Lenihan, M.T. Sykes, B. Smith, S. Sitch, and K. Thonicke. 2003. Simulating past and future dynamics of natural ecosystems in the United States. Global Biogeochemical Cycles 17: 1045. doi:10.1029/2001GB001508.			X				Addressed in the "Data Gaps" section and added to the 7th bullet under "Key Findings".
11-044	7	11	11-3	29	The uncertainty of the estimates of forest carbon suggest that the text should use an appropriate precision of two significant figures. Therefore, change 109 Mt C y ⁻¹ to 110 Mt C y ⁻¹ and round other numbers throughout the report to two significant figures.			X				Did some rounding in the tables and text.

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11-045	7	11	11-7	24	Data from humid evergreen tropical forest in Costa Rica show one impact of climate change on forest growth, namely, reduction of annual growth due to increased respiration at night (Clark et al. 2003). REF: Clark, D.A., S.C. Piper, C.D. Keeling, and D.B. Clark. 2003. Tropical rain forest tree growth and atmospheric carbon dynamics linked to interannual temperature variation during 1984–2000. Proceedings of the National Academy of Sciences of the USA 100: 5852-5857.						X	
11-046	17	11	General		This document seems a bit thin and out of date in places as per the situation in the US.	X						
11-047	17	11	11-3	1-5	The units in this section are completely inconsistent with one another. In Canada, they are given on a per ha basis, whereas for the US and Mexico they are given as totals. How can we compare these?		X					
11-048	17	11	11-4	1-7	This section need to include the critical issue related to the close ties of C and N in soils. Nearly all N in soils is tied up in organic matter, and it is not possible to add C to soils without adding N – unless one throws the C:N ratio way out of whack, potentially causing N deficiencies, lowered primary production, and therefore lower ecosystem C sequestration.			X	X			Agree with the comment, but disagree that this section should be changed. This part is simply a report of the stocks. This comment might be appropriate for the "Principles of Forest Management" appendix, but we couldn't really touch this comment about N fertilization in soils unless we delve into the whole fertilization gamut. To do that we'd want to deal with C:N ratios, other N transformation effects, mechanisms for C to enter recalcitrant pools in soils, and etc.etc.
11-049	17	11	11-7	1-24	I am surprise that the recent studies on the effects of elevated CO2 at the Duke site by Finzi et al are not included here. The Duke study is the longest-term study in a forest ecosystem		X					
11-050	17	11	11-8	15-17	Surely there are later figures for fires in the US than a 1998 reference. The US section here seems a lot less comprehensive than that for Canada. More homework should probably be done.					X		Checked again and can find no more recent comprehensive and citable estimates
11-051	21	11	General		The one issue that I disagree with the authors on is that they downplay the importance of roots and really consider that aboveground litter lands on the soil surface and that DOC leaches down. In some boreal systems more than 75% of C fixed in the ecosystem goes directly into the root systems. In peat soils of the Arctic, most of the "soil" is just dead roots. I think the authors should revise their consideration of how SOM forms to give more credence to the importance of roots and "direct injection" of organic matter.		X	X				we are not giving anyone "our" interpretation of how SOM forms, but rather reporting on values we found in the literature. We can't possibly turn this into a study of the biochemistry of SOM-forming processes. Second, the comment about root-to-shoot ratios being greater than 1:1 is certainly wrong for the forests we are addressing, e.g. see Kurz et al. (1996) and Li et al. (2003). It may apply to tundra systems but that's outside the scope of this work.
11-052	21	11	General		The main problem with the chapter is how they discuss sources of soil organic matter. It is consistently presented as a process where litter lands on the soil surface and then must be transported into the soil. In fact, in high latitude systems the root:shoot ratio is much greater than 1. That means that most of the C entering the decomposition system is injected into the soil via root growth. Roots may well provide the bulk of C that becomes soil organic matter.		X	X				See previous response
11-053	21	11	11-3		DOM usually means "dissolved organic matter", rather than "dead organic matter."		X					

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11-054	34	11	General		I have also quickly reviewed chapter 11, Agricultural lands, grasslands, shrublands, and arid lands. It is factual and covers the main science topics although also rather inward looking (i.e. not taking into account what is happening elsewhere) I find this less of a problem for this chapter, although the document title implies it will address "implications for global carbon cycle".	X						
11-055	34	11	General		In the Economics and policy assessment section, you may wish to consider discussion of options such as payments for environmental services, costs to the agriculture sector in adapting to carbon imbalances, initiatives and opportunities in the large multi-national food corporations to deal with carbon-related issues.				X			
SH-003	SG	11	11-8 and 11-9		I think it worthwhile pointing out that the comments in Chapter 3 (top of page 3-5) regarding the likelihood of increasing C sink associated with lengthened growing season have recently been clarified in work indicating that a substantial portion of N.American forests are actually in decline under a warming climate (probably an acclimation effect) whereas tundra areas are increasing in productivity. [REF: Goetz, S. J., A. Bunn, G. Fiske, and R. A. Houghton. 2005. Satellite observed photosynthetic trends across boreal North America associated with climate and fire disturbance. Proceedings National Academy of Science 102:13521-13525.] This assessment, using 22 years of satellite imagery, accounted for the influence of fire disturbance. These points are also relevant to Chapter 11 (pages 8-9). I think we have to be cautious about this assumption of increasing productivity, particularly when the observations suggest otherwise, before changes in vegetation composition catch up with the new climate regime.		X	X				I do not read our text to be a strong endorsement of increasing productivity-- it simply reports what some of the projections are showing. The paper cited here reflects a few years of satellite observation of just the boreal forest, and I believe there are some other similar studies that do show increasing NPP in temperate forests. A bit more uncertainty was added to the discussion and cited this paper.